

**The WORLD SCANNER REPORT**

A Journal of VHF-UHF Scanner Technology &amp; Engineering

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**WELCOME NEW & RETURNING READERS!**

Gee, the second semester of 1992 is upon us already! Already, the days are getting shorter and the downhill slide to Christmas has begun. (*I'm just getting over last year's!*) Thanks to a recent press release in "Monitoring Times" Magazine, we've had a sizeable influx of new readers. Cancellations and expirations are continuing to run very low at less than 15% so the WSR subscription rolls have reached an all-time high. THANK YOU and welcome to all! We hope to live up to and even exceed your fondest expectations!

**BACK-ISSUES ALWAYS AVAILABLE!**

The WSR started publishing in January, 1991, so counting this issue, we have released sixteen issues so far; five in each half-year. The back-issues will be available for the foreseeable future, and as time passes, we'll try to drop the price to an affordable level. Most of the material in each issue will remain relevant and pertinent for a long time to come, and there are fixed costs to keeping them in print and in stock. But we'll try to price them accordingly to account for economies of postage savings and bulk handling. The bottom line is that if you don't have the back-issues, you'll need them. See the inside-bottom of the last page for an order blank and prices to bring you up to date.

**APOLOGIES TO THOSE WHO WERE OFFENDED**

by my reply, last month, to a reader, John Morris, about scanners and the computer age. I received several outcries, including one from Mr. Morris. Try as we may, I guess it is almost impossible to avoid giving offense to some folks some of the time. I certainly intended no offense to anyone in my staunch defense of computers as related to scanners. I simply meant to convey that the Computer Age has invaded our hobby and whether we like it or not, it is here to stay for a while; probably forever. Modern programmable scanners come with a microcomputer inside. I suppose it is rather transparent in those 10-ch jobs, but if yours has 50 or more channels, there is just no way that you can extract the ultimate in utility and application without a computer to assist you in one form or another. I mean it, ONLY a computer can control another computer with ultimate efficiency and accuracy. Even if you use a computer to do nothing more than keep track of frequencies, you're accomplishing much more in less time than by the old hand or typewritten methods! Perry Joseph succinctly points this out in his continuing series on Scanner Frequency Management.

The modern 400-ch PRO-2004/5/6 scanners cannot come close to effective utilization and realization of max potential without the aid of a computer and that's all there is to it! I'm talking fact, sum and substance here; not idle whim, fancy and subjective opinion. If the facts invade your personal comfort zone, I can understand and even sympathize with personal preferences for the contrary. But I have to do my job, and I do it matter-of-factly. I don't mean to be brusque and diffident; it's just that there's limited space in which to do the job, so I have to economize, even in my words. If they seem short and curt, please know that it is not personal.

I understand how even today, there are people who don't like or appreciate the conveniences of modern technology. The Amish and Mennonites, for example, continue to live simple lives in the old way, shunning modern miracles of technology. I suppose there's a bit of the Amish in many of us in the sense that just about the time we become comfortable with what Life has to offer, SHAZAMM! Along comes a new technology to turn everything upside down. In the process, perhaps we tend to forget the **BASICS** of Life and Living. So I appreciate your positions, those of you who would prefer to hold the reins tight and proceed along at a leisurely gait. It's just that I can't hold in the reins since my Cosmic drive is to find, develop and convey new ideas and ways to make scanning more palatable; easier to do; and at least, manageable by the typical hobbyist. A casual survey of the WSR's subscription blanks which you filled out indicates the great majority of Readers have computers and appear to know how or want to know how to use them in the scanning hobby. Scanning is only now coming of age in its own.

THINK about it, and compare it to Shortwave Listening or even Amateur Radio. The "shortwave" spectrum consists of the band of frequencies from DC to 30 MHz. Sounds like a lot. The "scanner spectrum" starts at about 25 MHz and continues through 1300 MHz or even 2000 MHz, depending on the receiver. Now consider that DC to 30 MHz contains exactly the **SAME** amount of spectrum as 25 MHz to 55 MHz! Scannists have to deal with another 1245 MHz on top of that! It's NOT a job that can be effectively managed by the casual working stiff, nor even the most brilliant engineer, if you want to know the truth! Scanning can be exploited beyond a superficial degree **ONLY** with the help of a computer, and I have to be instrumental in the transfer of that computer technology to the hobby.

But fret not, please. I am always on the lookout for any tidbit of knowledge or gizmo that will bring increased enjoyment of radio to scannists. I know your time is limited and that you want to make the most out of it. A computer is one magnificent tool that will not only

maximize your available time, but also will open new doors to radio for you. There are things that one person with a computer and a scanner can do today that an entire military force or spy agency could not do twenty years ago. Computers & dozens of other subjects hold positions of honor on our agenda. We will use computers like a mechanic uses a wrench, but the "World Scanner Report" is not going to become a computer rag. My formal assessment is that since scanners come with computers *built into them* nowadays, it's not a departure from the main theme to apply other computers to make the itty-bitty things work even better! If you don't like computers, so be it; I don't like 'em either. But my scanner has a half-baked one inside and the new HB-232 Scanner/Computer Interface with my \$200 clunker PC/XT literally multiplies the utility of my PRO-2004 by a factor of somewhere between ten and a hundred. Some of you may not realize there is a computer in your scanner. That's called "transparent". The HB-232 will let you operate a scanner without paying too much attention to the computer, but your monitoring capability will multiply by 10-100! Such power cannot be ignored or overlooked in the "WSR".

#### FROM THE FIDONET, A READER'S TIP ON MOD-33

Tuesday, June 2, 1992, Gary Ross writes: Bill: I saw a new PRO-2006 yesterday, Model 20-145A. Looked inside and saw the two diodes on the back of the display board 'in the clear', no potting; easy to access.

Those diodes never were potted anyway. Nary a sweat to clip 'em both; one for speed and the other for cellular. The only difference I can tell between the PRO-2006 and 2006A is that they did away with the DIMMER button and made it an ON/OFF button for the background lighting.

Got a tip for your MOD-33, the Automatic Tape Recorder Switch! Instead of messing with a hard-to-find ground-isolated jack for the back of the scanner, just use a stereo phono jack, 1/8" or 1/4", and tie the R and L channel lugs to the MOD-33 relay contacts! Solder the R & L lugs of a matching stereo plug to the pair of wires in the Remote Cable! The grounded lug of the plug and jack would not be used in this case.

EDITOR's COMMENT: Geez, I feel ignorant! Dunno why the hell I never thought of that, but sure as tootin', that will do the job! So simple and yet so elusive. Thanks!

ATTENTION ALL: MOD-33 in my SCANNER MODIFICATION HANDBOOK (Vol-2) offers a neat way to trigger a tape recorder ON when signals are present, and to PAUSE when there are no signals. It works absolutely great, but the Remote Jack on most tape recorders is isolated from ground and will not work if it gets grounded to the scanner chassis. So I cautioned hackers to use a ground-isolated jack on the rear of the scanner or to employ some method to keep from grounding either wire of the Remote Cable. No big deal, just a pain in the butt. And now, Gary Ross gives us a most elegant solution! Bravo!

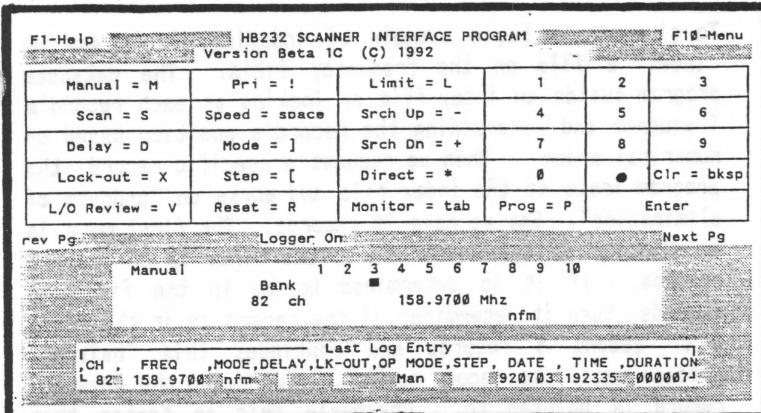
#### SNEAK PREVIEW OF WHAT'S COMING! The HB-232 Scanner/Computer Interface

See the colored insert sheet with this issue for fuller details, but you dear readers are among the first to know about a soon-to-come computer interface that has the potential to create a whole new dimension to scanning! The HB-232 will do so much that you'll be a long time exhausting all its capabilities, (you may never exhaust them all!) and yet it is simple enough to be operated with great effectiveness from the very start! The HB-232 is so powerful that YOU can accomplish as much or more communications monitoring than an entire military force of only a few years ago. All you need is a PC/XT/AT/386/486 or clone with 512-k RAM, a PRO-2004, PRO-2005 or PRO-2006 scanner, an HB-232 and a few other easily obtained materials. In my tests, I am using an old junker 640-k, XT/clone that cost me \$200 last November. Actually, it cost \$100 and the 40-Mb hard drive was another \$100.

The HB-232 allows complete two-way user interaction & control of the scanner from the computer's keyboard or the front panel of the scanner. It's what the computer can do, even a clunker, that makes all the difference, however. Here is an example: do you get a hollow, empty feeling from the PRO-2004/5/6's SEARCH modes when it runs into and stops on useless pager frequencies, "birdies" or other worthless signals? I've had many requests for a "Search Frequency Lockout" mod. Well, it comes standard in the HB-232! You can EASILY tell the HB-232 which frequencies you don't want it to stop on during a SEARCH session, and it won't! You can add all your scanner's birdies to the list as well as frequencies for pagers, data, and other non-voice signals; and even the more common voice frequencies which you don't want to bother with during a serious SEARCH session! Oh, not interested in entering all the birdie frequencies from your scanner's Owner's Manual, especially when that list is neither accurate nor complete? Relax; it's a simple matter to command the HB-232 to locate and log ALL your scanner's birdies while you go off and do something else. (This is about a 90-minute job, since it takes the scanner THAT long to SEARCH between 25 MHz - 1300 MHz anyway.) Oh, and when the HB-232 finds a "birdie", it logs it into the list and then directs the scanner to resume SEARCH automatically. This, like many other HB-232 processes is an automatic, hands-off procedure.

Never is the scanner's normal operation affected in the slightest. Unlike other interfaces which can slow down the scanner to a snail's pace, the HB-232 doesn't do anything to the scanner's performance other than control and/or monitor it! The HB-232 Scanner/Computer Interface is compatible with all known scanner modifications including speedups with one exception: it might not be compatible with the PRO-2006 and a quartz-crystal speed increase. You might have to operate the HB-232 with a 12 MHz PRO-2006 for a time while we seek ways to make it work at faster speeds. In any event, the HB-232 will work just fine with speeded up PRO-2004's and 2005's.

Below is a print of the main operating screen of the Beta Test version of the HB-232. The final version will probably change a little, but we've got it pretty close.



Now let's explain that screen briefly: The top line is the Main Menu which is hidden until you press F10 or F-1. The Main Menu consists of Functions, Subfunctions, Tools, Input/Output Control, Config or Setup and a Help File. Functions are Autologger, Autoprogrammer, Birdie Checker and a powerful Macro or Script function. Subfunctions include several different ways to run the anti-Birdie features. Tools include the standard text editor as well as two more that you can supply and define here (DOS utilities such as LIST or XTREEGOLD, etc). I/O Controls include toggles for the four User Switches which can be used to switch unrelated scanner functions and your own modifications by means of the computer and the HB-232.

The next half of the screen is a reasonable facsimile of the scanner's keyboard and does nothing other than serve as a visual cue or aid to the corresponding key functions at the computer. This section of the screen can be page-switched to display other activities. Various functions, if active, will display just under the Keyboard Matrix.

The large rectangle just below the Keyboard Matrix is a facsimile of the scanner's LCD Display. Everything that can be seen in the scanner's Display can be seen in this large rectangle represented almost exactly like it is in the scanner. You should feel very much at home here.

The bottom area indicates the most recent logging. The format may be confusing at first, but it is easy to master and the indicators on the screen make it even easier to see what's going on. That line is explained below, to show its simplicity:

LAST LOG ENTRY is self explanatory. Immediately below this line is the layout or structure for the Autologger sequence. Immediately below the layout is the actual data that was last logged to a file. The example shows:

```
-----Last Log Entry-----  
CH FREQ MODE DELAY LK-OUT OP-MODE STEP DATE TIME DURATION  
82 158.9700 nfm Man 920703 192335 000007
```

which is explained as: Channel 82 containing 158.970 MHz set to NFM mode, no delay and not locked out, in MANUAL

mode (not Scan) on July 3, 1992, at 7:23:35 pm and the signal was logged for 7-seconds. If the SEARCH mode had been selected, the STEP field would have shown the KHz Increment and OP-MODE would have shown SrUp or SrDn instead of Man. DELAY would have shown a "D" if set and LK-OUT would have shown an "L", if locked out. Time is given in 24-hr format and duration is in HHMMSS.

Not given here is another screen that shows the positions of the 4 User Switches as well as 5 "status" inputs that can be determined by the operator. Status inputs can be used to observe other normally hidden functions of the scanner, such as SQUELCH, on/off status of mods you did, hi-temperature alarms, overvoltage conditions, and much, much more. The uses for this input/output sensory & control feature are virtually unlimited, or at least limited mostly by the extent of your imagination!

What more can I say here? I'm tempted to go on and on, but the enclosed info sheet will tell you more about the HB-232; enough anyway, so that you'll know whether or not one is for you. I will be happy to answer questions by mail or on my Computer BBS at (619) 578-9247 after 5:30pm and before 1:30pm, PDT. In fact, after the HB-232 goes on sale, I will provide technical support and a special message area for it on my BBS to make available another powerful resource. Registered owners will be able to access special script files and perhaps maintenance upgrades to the software. I am convinced that the HB-232 is the best thing to come along since radio itself and that it will usher in a new age, a new approach to VHF-UHF scanning. Mark my words! The neat thing about the HB-232 is that it can put REAL monitoring power in the hands of the greenest neophyte. Imagine, then, the power available to the dedicated, experienced scannist! It's almost too good to be true, but the HB-232 is real enough: I've been testing one for over a month now! More next month, but if you want to catch the latest on the HB-232, feel free to log on to my BBS and download from the Scanner File Section a file called HB232R.ZIP, or if you can't unZIP compressed files, then download HB232R?.\* to get all the text files on that subject.

#### SCANNER FREQUENCY MANAGEMENT - PART 4

by Perry Joseph, President, DataFile, Inc.  
Developer of ProScan Frequency Management System.

Now that I've covered some types of database programs, let's focus on some of the features needed to manage a frequency list. First, we need to consider the format and substance of the data. Most databases require the operator to setup or layout the structure of each data file. This "structure" consists of the name of each field, the type of field (alphabetic, numeric, date, time, etc.) and the size (width) of each field. Here is a prime example for you: the HB-232 Scanner/Computer Interface's Autologger function creates a comma-delimited text file with the following field names and widths. This file is eminently suited for immediate export into a database, but the database has to be structured first:

FIELD NAME	PURPOSE OF FIELD	FIELD LENGTH (WIDTH)	TYPE OF FIELD DATA
CH	Channel Logged	3 chars	Numeric
FREQ	Frequency (MHz)	9 chars	Numeric
MODE	NFM, WFM or AM	3 chars	Alphabetic
DELAY	D=on; blank=off	1 char	Alphabetic
LK-OUT	L=L/0; Blank=active	1 char	Alphabetic
OP MODE	Manual, Scan or Search	4 chars	Alphabetic
STEP	Search Step Increment	4 chars	Numeric
DATE	Date of logging	6 chars	Date
TIME	Time Logging began	6 chars	Time
DURATION	Length of logging	6 chars	Time
TOTAL RECORD LENGTH		43 chars	

It's important to pay some attention here because any mistakes made when you set up the structure of a database may have to be lived with later. You will want to avoid miscalculating available disk space and creating a record size so large that when multiplied by enough records, winds up hogging half the hard disk (*hard disk bloatus*). This is probably not a concern for those who will only be keeping a few hundred records on large capacity hard disks, . Some database programs allow the expansion of existing fields or adding more fields to the record structure at a later date without losing data already entered. Making an existing structure smaller can result in loss of data in some programs so it is wise to use a database program that allows modification of the data structure AFTER it has been created and data entered.

Those who share data with others may be concerned with compatibility of data structures and file formats. According to market statistics, the most popular format is the dBase format, files from which usually have a file extension name of ".DBF". Another popular format is called System Data Format (SDF) which is a standard ASCII file where each record is fixed length, ends with a carriage return and line feed, and an end-of-file mark. (Ctrl-Z). There are other formats, too, but let's not be concerned with them at this time.

Many database programs offer the ability to export/import to or from other popular formats. There are utility programs which handle all types of data conversion from one format to another like Data Junction by Tools & Techniques (800) 444-1495, or DataFlow by Information Management Systems (800) 477-0774. Once data is defined and entered, accessing the data becomes the main task. Assuming we are going to track more than a hundred frequencies and don't want to wait for the program to look up a specific record (anything over one second is "having to wait" in this author's opinion), we will want to use a feature called indexing. The more powerful database programs offer this feature. Indexing takes the form of an auxiliary file based on a key field or fields of each record. Indexing is, in fact, sorting a data file without having to change the physical locations of the records. Indexes can be "active" and are built as we enter data; unlike physical sorting which is usually a routine, separate from entering data and may require

additional time depending on how fast your computer is and how much data you have.

To give you a basic example of indexing, let's say we "index" a file on the frequency field. The database program builds an index file by looking at each record's frequency and determining the record's position based on numerical order. When we request a specific record, the program looks at the index file and works on "process of elimination". Say we have 20 records. The first move is to discover if the record is in the first 10 or last 10 records. If it is determined to be in the first 10 records, then it determines if the record is in the first 5 or second 5 records and continues this "halving" process until the record number is found and the physical record is pointed to. Obviously this is faster than having to look at each physical record until the correct record is found, unless of course the record happens to be at the beginning of the file. You can have multiple index files as well. In addition to the frequency index, we could have an alphabetical index for the name or location or a combination of both for a frequency user. Of course, the more index files we have, the more disk space we use.

Printing data is important too. We can utilize the index files so that we print our data in a specific order. We will also want to print data based on a specific condition or "boundary". This allows us to print specific records without having to print them all at once. If we are diligent about keeping our data to a minimum, and if we use 8-1/2" by 11" paper, we can print approximately 80 characters on each line of our report using draft mode (roughly 10 characters per inch). We can increase the number of characters per line by using the "condensed" (17-cpi) mode, assuming the printer is capable. Ideally, we will find a way to print a full frequency record on one line. This saves paper, not to mention trees. These are some of the features needed to minimize the time in managing our data. For those who find these details tedious, boring or simply don't have the time, money or urge to become a *database programmer*, STAY TUNED. In my next installment, I will provide you with an easy solution to frequency management which offers the powers of a professional database package for less than the typical database price. Until then, I hope you're enjoying your Summer. Pass the buns please!

SCANNER FREQUENCY ACTIVITY TAGGER  
FOR THE PRO-2004/5/6 & MAYBE OTHER SCANNERS  
By: Professor Feabody

Greetings Fellow Scannerfans! Good stuff this month! Have you ever purchased a frequency guide and rushed headfirst to punch in all those new freqs? And then, after loading up a Block of 400 channels, sat back and hit the SCAN button .....only to wait .....and wait?... And then you go get a cold can of something or another and come back and wait some more. Then, wow! You jump!

You've got one now!! One freq has some activity! Great! It's a keeper. Now you only have to wait for 399 more. (Gloom) About then you wish you had some way of finding out which freqs are duds and which ones are good. Well listen up, Pards, I've got a quick and cheap way to tag active channels. A neat little function lurks on the keypad that just waits to blossom and do the job. Its the lowly LOCKOUT key. HUH? Say what? Yeah, that's right. Finally, there's a great use for the sucker!

The LOCKOUT key, in conjunction with the LOCKOUT REVIEW key, will form a great team to tag by LOCKING OUT all active, but ONLY active channels. My slick & wicked, easy little circuit waits for a SQUELCH break and then generates a half-second pulse to activate a single CMOS bilateral switch that's wired into the keyboard to electronically press the LOCKOUT key. Then the scanner resumes SCAN until the next squelch break. Upon the next break, that channel gets locked out also. As active channels get locked out, the odds of finding even less active channels are increased. You know which ones are busy and you don't have to worry about writing down who's who because they are all tagged with the LockOut. You can even leave the radio on when you're gone and it will still find and tag the active freqs. Obviously, you want to start the operation with no channels LockedOut and let the AutoTagger do the work for you.

Of course, the same caveats apply as for the Search & Store Modules; namely RF & atmospheric burps will break squelch, but its easy later on, to see which ones are intermods and which are truly active. So, after an AutoTag Session, turn off the AUTOTAG function, set the radio to channel 1, and press the LOCKOUT REVIEW key to quickly scroll through all the tagged active channels. Write down on a piece of paper or better yet, put them right into your computer so the OL' FATMAN (or the new HB-232 Interface) can load them back into your radio in a flash. If you originally put all the freqs into the computer to have an interface load em' in, all you have to do is remove the unused freqs; do a sort and you're ready to reload with just the plain good stuff.

The circuit is a snap with only 2 chips: one half of a "one shot" and one quarter of a CMOS switch. If you built & installed the Extended Delay function (MOD-29), use the other half of its 74HC123 chip for economy, if you like. The Q output of the 74HC123A is connected to a CMOS bilateral switch which controls two pins of the keyboard connector that make the LOCKOUT function. The switch should be very close to the keyboard connector with only 1-1/2" inch wires from U-2, Pins 1 & 2. The other wires can be of any practical length. A +5v high from the Q output puts a +5v high at the control pin of the switch and makes the switch close. The 1/2-sec pulse will come at the end of the scanner's squelch break to LockOut the channel. I experimented with a number of trigger points and found the Squelch Gate to be best. Other points caused 2 LOCKOUT pulses to be created which locked out not only the desired channel, but the next one, too! Yuk!

One thing to note: I have set up the circuit so that when you enable the TAG function it will immediately output a Test Lockout pulse. This is an operational check, so just press the LOCKOUT key to remove the lockout and you're ready to start the tagging operation. Just be sure to unLock ALL channels before you start AutoTagging. That's it for this month's circuit, so enjoy to the max!

**IF YOU HAVE TROUBLE:** Especially if the AutoTag function seems to be erratic, add another one (maybe two) 2.2-uF capacitors in parallel with C-1. Otherwise, there is nothing unusual or persnickety about this circuit. If it doesn't work, you've made an error somewhere.

**OTHER SCANNERS?** I dunno, but why not? All you want is for the SQUELCH gate to trigger a 1/2-sec control pulse to a bilateral switch, the contacts of which should be wired to your scanner's keyboard matrix, the one column and one row that's for your LOCKOUT key. Study your schematic diagram to make this concept clear. There is a major difference between the SQUELCH gate circuits of the PRO-2004/5/6 and other scanners that you will want to note: The PRO-2004's SQUELCH gate at CN-504, Pin 9 is high at +5v when SQUELCH is set and low at 0-v when SQUELCH breaks. The PRO-2005/6 are the same, but at CN-3, Pin 5. Most other scanners use an opposite logic gate: low for SQUELCH SET and high for SQUELCH BREAK. No problem with my circuit, but a minor change will be necessary. Refer to the schematic and make the following change for most all scanners other than the PRO-2004/5/6:

**SCHEMATIC CHANGE FOR MOST OTHER SCANNERS**

1. Connect Pin 2 of U-1 to the +5v Supply.
2. Remove the ground at U-1, Pin 1, and use Pin 1 for the input of your SQUELCH GATE signal.

No other changes are necessary.

**NOTE:** If the SQUELCH logic in your scanner is +6 to +8v, then be sure to power this circuit with the same levels. 74HC CMOS circuits must always be powered with the same voltage, give or take 0.5-v, as the high signal level!

**NOTE:** For information about the SQUELCH gate signal location in your scanner, refer to back issues of the "WSR", V1N4, V1N7 & V1N9 for detailed data about the NFM/SQUELCH chip, logic & pinout for your scanner.

**FATMAN INTERFACE UPDATE:** By the way, I received the newest version of FILE EXPRESS that I use with the FATMAN and it has a new feature that is well suited to scanner databases. A tagging function is available for cut & paste operations with sections of your database. This makes it easy to rebuild your main database and to manipulate and change data as you wish. This will work hand in hand with loading in new freqs that you found with the AUTOTAG function. FILE EXPRESS is available as shareware. I would like to hear from any of you who built the FATMAN Interface and about your results. Remember, technical help with problems is always available from Doc and me. /Prof Peabody

HOW TO DO SCANNER MODIFICATIONS  
or  
HOW TO PROPERLY HACK YOUR SCANNER

That is the question, it seems. For some reason that I haven't determined, there has been a rash of mishacked scanners come across my bench. For the first couple of years after my SCANNER MODIFICATION HANDBOOKS were out, I was pleasantly surprised at the very few mishacks and serious errors that came to my attention. Frankly, I was prepared for a flood, and when few came, I was lulled into a false sense of security. Maybe it's a new generation now; maybe other factors have entered into play, but all I know for sure is that I've seen an awful lot of shoddy work lately; all of a sudden-like. It's time to get back to the basics. Several common factors emerge which are worth talking about a little:

SOLDERING TECHNIQUES: Frankly, good soldering is neither an art nor a science. It's just a part of the job, but there are a couple of things to know in order to make your work successful. A little too much heat is better than too little heat! Low heat can result in cold solder joints. If they don't cause trouble now, they will later, probably at a most inopportune time. Your soldering pencil should be rated at a minimum of 35-watts and preferably closer to 50-watts. The tip of the soldering iron should be of the "iron clad" variety; not copper. After it's up to temperature, the tip should be wiped on a soaping wet sponge before and after every solder connection. This keeps it clean and ready to melt solder. Immediately prior to making a solder joint, apply a dab of solder to the tip and then touch the tip to the connection; wait for one second and then melt solder to the connection, NOT to the tip of the iron. This process will require another second. Then remove the solder, but leave the soldering tip on the joint for another second and then remove it. After the joint has cooled, it should be bright and shiny; not gray and wrinkled. Solder, at the right temperature, will flow into the heated joint to make a permanent connection.

USE OF HOOKUP WIRE is an underrated subject. You should use only good quality, small gauge, stranded, and very flexible hookup wire for your scanner hacking projects. This eliminates Radio Shack's selection of "welding cables" that they call hookup wire. The insulation drips like melted candle wax and these wires are much too stiff and rigid for our light duty needs. Surprisingly, Radio Shack used to have some great wire, though it's been formally discontinued now. Still, most stores have some in stock, and you should lay in a supply. But it's not what you think it is! We're talking about their Computer LAN cable, #278-776 (25-cond) and #278-775 (9-cond). You have to strip off the outer gray insulation and then remove the braided and foil shields, but what's left is some of the finest color-coded hookup wire you ever saw in your life! This stuff is so great, you'll wonder how you ever did without it. It's very flexible; strong and easily handled in most all circumstances.

I cannot over emphasize the use of good quality hook up wire in your hacking adventures. Use ONLY the type of stuff I have described above, and if you can't locate any or don't know what I am talking about, then send me a SASE and request a "hookup wire sample" which I'll be delighted to send. If worse comes to worse and your local Radio Shacks are out of the good stuff, go to your local electronics supply house and ask to see a sample of their 25-conductor, shielded computer LAN cable. That's the stuff that you probably want. Send me a sample for my evaluation if there is any doubt.

INSTALL THINGS WITH A PLAN or else suffer some expensive or heart-breaking consequences later. What do I mean by "Plan"? Harumph! I know you better than you know yourself. See, if you sneak into your scanner and pull off a mod successfully, it won't be long before you're back in there sticking something else in. And then again! And again. If you don't take this into account from the very start, then your scanner is going to get cluttered and boogered up before you know it. And then, what if trouble arises with some real hairy mod? Well, your troubleshooting and diagnosis efforts will then be severely hampered for one thing, and if you later draw a blank and ask me to service the unit for you, I probably won't do it! There's just no way that I can invest 8-16 hours of my labor, only to draw a blank like you might.

The moral here is to install each and every mod in an out of the way place as if there will be a hundred more to follow. Dress all wiring cleanly and neatly and out of the way. Wire bundles should be routed around the perimeter of the scanner, for the most part. Little circuit boards can be soldered to the metal sides of the scanner. The power transformer can be removed to create more room for the larger mods, and besides, it's better to power the scanner from an external DC power supply anyway. Runs cooler and makes things last longer.

For the most part, digital modifications are not critical with regard to wire length. Exceptions to this include extended memory modifications and mods which have to connect to the Keyboard matrix of the scanner. In these two exceptions, keep the wire runs extremely short. Otherwise, digital mods can be installed most anywhere. RF mods have to have short wire leads and audio mods should have some attention paid to wire length, though not as critical. Another rule of thumb is that all ground wires should be as short as possible, while DC power leads can be of any practical length. Hobbyists tend to be impatient and hurried in their work. Force yourself to slow down; do things one step at a time, and make each step as perfect as possible before proceeding to the next. Use Davy Crockett's motto: **"Be sure you are right and then go ahead".**

THE RIGHT TOOLS & MATERIALS are very important to good hacking! For Pete's Sake, throw away those rolls of black electrical tape and duct tape. Same for cellophane and masking tapes. Yuk! Sometimes, Scotch 810 Magic Tape can be useful for wrapping wire bundles, but better



still are cable ties, heat shrinkable tubing and short lengths of bundling "spaghetti". Anything is better than tape! NEVER use tape to insulate solder joints & wire splices! You can bet your bottom dollar the stuff will come undone when you least expect it! Uncouth!

Tools....a good subject. Yes, I have a few cool thousand invested in good tools of the trade but you know what? I use less than a hundred bucks worth for 95% of my needs. Following is what I call a good, functional tool kit for hacking & chopping scanners. I don't like a lot of Radio Shack's stuff, but what I listed below will be more than adequate for your needs

CHK DESCRIPTION	RADIO SHACK CATALOG No.
Electric drill, 3/8", w/bits to 3/8"	K-Mart, etc
Diagonal cutting pliers, small	64-1841
Locking Longnose Pliers	64-1864
Adjustable wrench, 4" (small)	K-Mart, etc
Precision flatblade screwdrivers	64-1948
Precision crosspoint screwdrivers	64-1962
Mini forceps	64-1910
Nibbling Tool	64-823
Lighted magnifier	63-848
Screwdrivers, assorted	64-1823
Needle file set	64-1985
Knife set	64-1801
Hot Glue Gun & Glue sticks	K-Mart, etc
Soldering pencil holder/cleaner	64-2078
Soldering pencil base unit	64-2080
Soldering element	64-2082
Soldering tips	64-2089 & 64-2074
Desoldering tool	64-2098
Pocket Penlight	61-2626
Disposable butane lighter	Anywhere

Now, all self-respecting hackers need "stuff" besides just tools. It's all self explanatory, though:

Silver bearing solder	64-013
Micro-mini solder	64-005
Desoldering braid	64-2090
Cleaner/Degreaser Solvent	64-3322
Rosin Flux Remover	64-3324
Double-sided tape	64-2344
Velcro (Hook & loop) strips	64-2345
Epoxy resin	64-2313
Super Glue	64-2308
Silicone rubber sealant	64-2314
Precision Lubricator	64-2301

And then, besides tools and "stuff", the hacker needs a small supply of widgets, gidgets and basic fasteners:

Standoffs w/screws	276-195
Perf board stock	276-1395
Machine screws	64-3010, 3011 & 3012
Machine nuts	64-3017, 3018 & 3019
Flat washers	64-3022
Grommets	64-3025
Wire ties	278-1632
Heat Shrinkable Tubing	278-1627
Dynamite; two-sticks; for last resort	?

Now here's the crazy thing about it all. You can take or leave these lists of tools, stuff and widgets which are not going to make or break you as a hacker. There's something else that I can't really give you directly; only awaken you to it: ATTITUDE! An ounce of the right attitude will go farther than a 100 lbs of tools and stuff. You've got to PLAN your hacking attack; stick to a methodology; and be patient. Yes, you have to be prepared with the right tools & materials, but putting attitude & patience at the top of the list will help the rest of the list take care of itself. If you are a novice hacker, don't outsmart me and take shortcuts. Follow along for a while and get used to the taste of success. I may seem to take the LONG WAY around at times, but it's with the BIG PICTURE in mind. /Bill

The "WORLD SCANNER REPORT" (c) 1991-2; V2N6: July, 1992; Page 8

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**IN THIS ISSUE**

ISSN-1061-9240

**FIRST CLASS MAIL**

- + Welcome To New & Returning Readers!
- + Back Issues of the WSR Always Available
- + Apologies To Those Who Were Offended Last Month
- + Computers & Scanning Discussed Again
- + A Reader's Tip for MOD-33; Automatic Tape Recorder Switch
- + Introducing The Coming New HB-232 Scanner/Computer Interface
- + Scanner Frequency Management; Part 4
- + AutoTagger For Active Frequencies; A Great New Modification!
- + FATMAN Computer Interface Update
- + How to Properly Hack and Modify Your Scanners
- \*\*NEXT MONTH: The New Realistic PRO-43: A handheld PRO-2006?**